Oct. 20, 1959 K. REES 2,909,049

HAND KNITTING APPARATUS

Filed Aug. 14, 1953 5 Sheets-Sheet 1

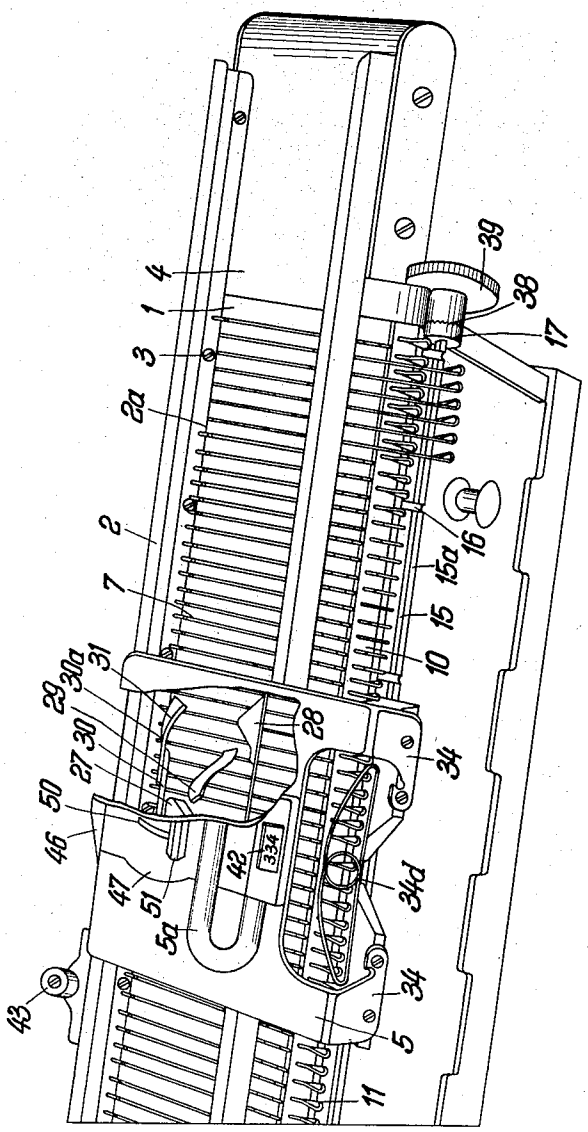


Fig. 1

KARL REES
Inventor:
By B. E. Shlesinger
ATTORNEY

Oct. 20, 1959 K. REES 2,909,049

HAND KNITTING APPARATUS

Filed Aug. 14, 1953 5 Sheets-Sheet 2

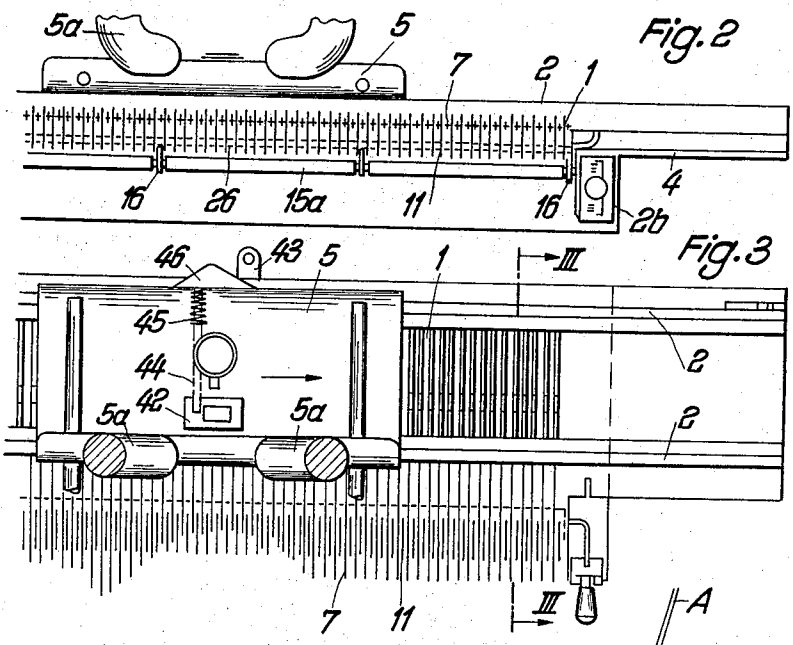


Fig. 2

Fig. 3

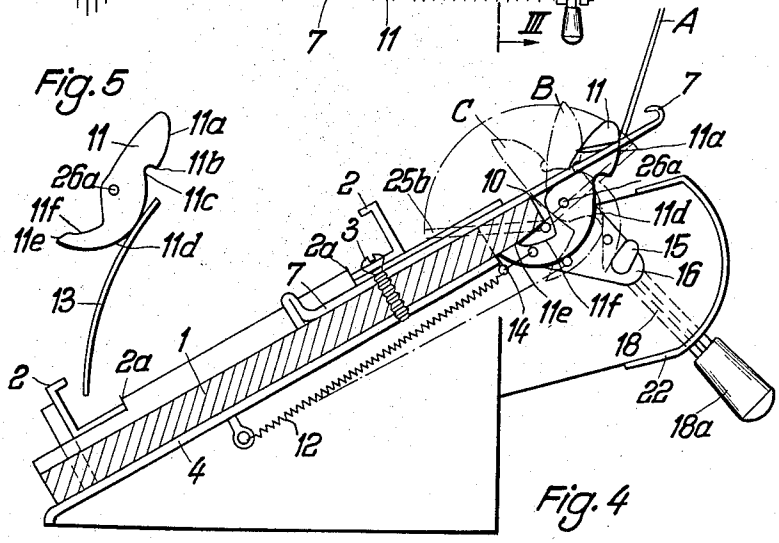


Fig. 5

Fig. 4

KARL REES
Inventor:
By
ATTORNEY

Oct. 20, 1959 K. REES 2,909,049

HAND KNITTING APPARATUS

Filed Aug. 14, 1953 5 Sheets-Sheet 3

Fig. 7

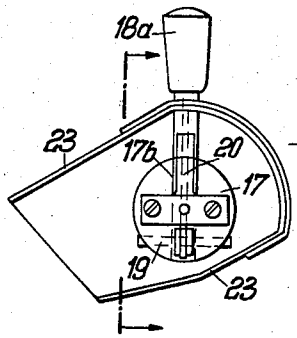


Fig. 6.

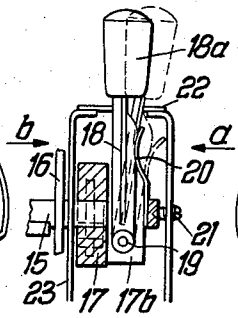


Fig. 8.

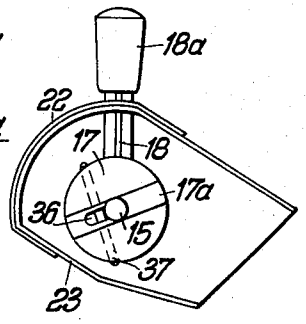


Fig. 9

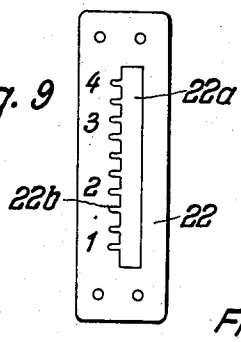


Fig. 10

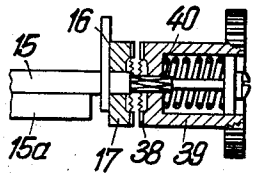


Fig. 11

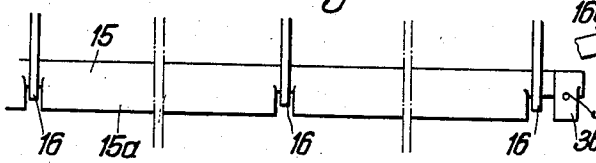


Fig. 12

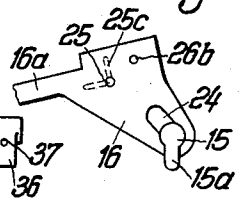


Fig. 13

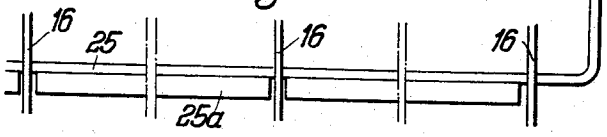


Fig. 14

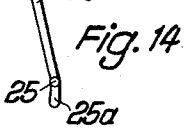
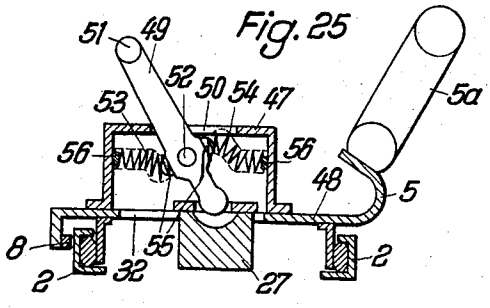


Fig. 25



KARL REES
Inventor:
By Reshbinger
ATTORNEY

Oct. 20, 1959 K. REES 2,909,049

HAND KNITTING APPARATUS

Filed Aug. 14, 1953 5 Sheets-Sheet 4

Fig. 15

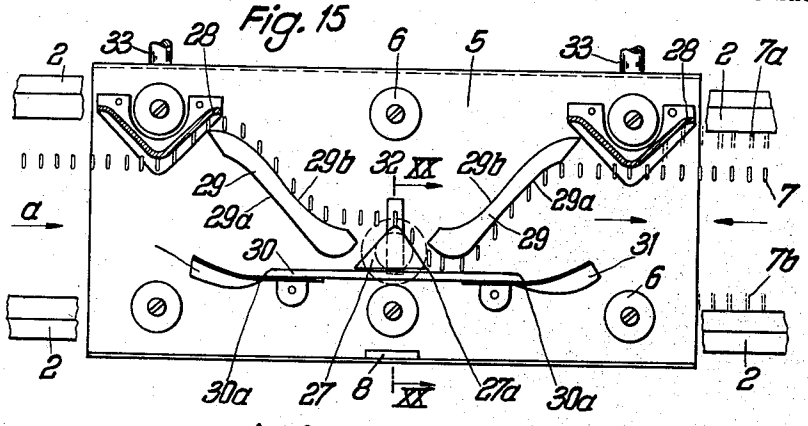


Fig. 16

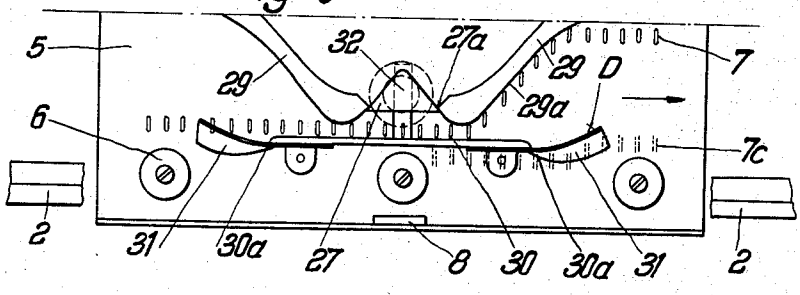


Fig. 17

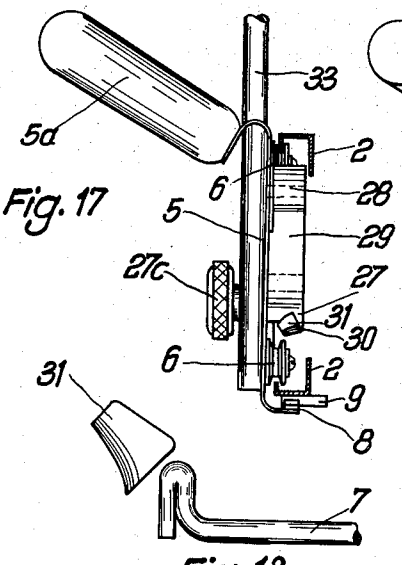


Fig. 18

Fig. 19

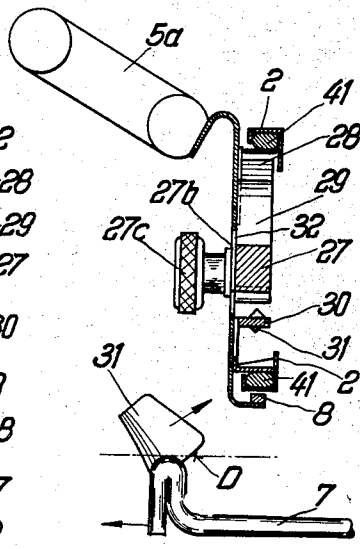


Fig. 20

KARL REES
Inventor:
By Beshlinger
ATTORNEY

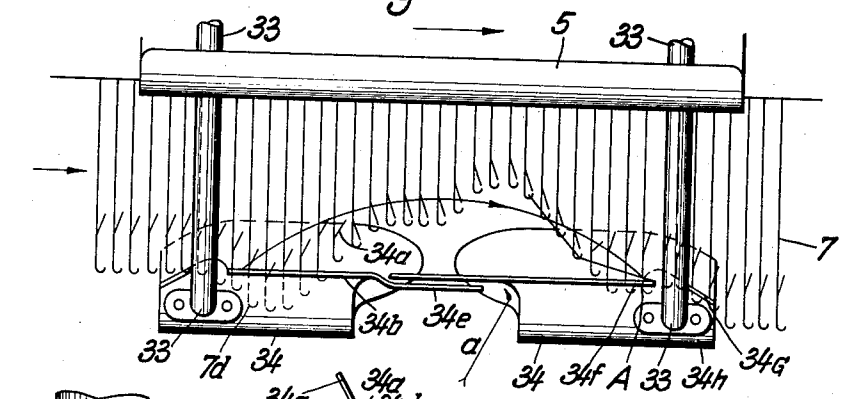
Oct. 20, 1959 K. REES 2,909,049

HAND KNITTING APPARATUS

Filed Aug. 14, 1953

5 Sheets-Sheet 5

Fig. 21



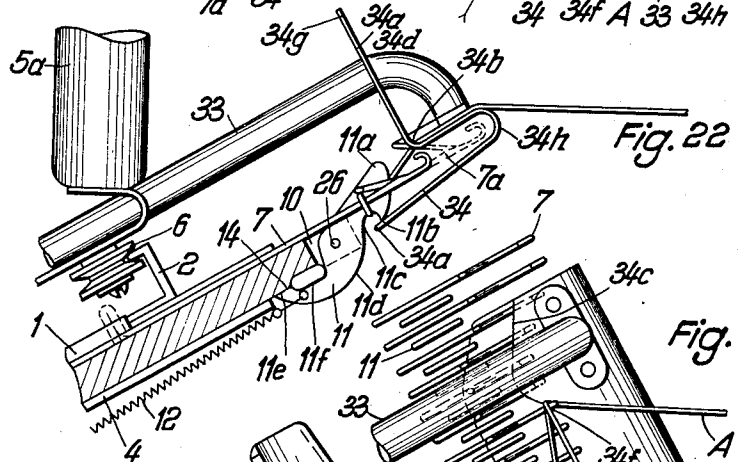


Fig. 22

Fig. 23

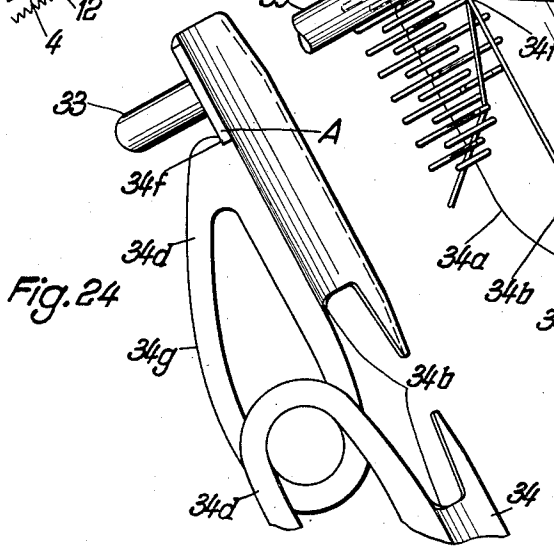


Fig. 24

KARL REES
Inventor:
By
ATTORNEY

United States Patent Office 2,909,049 Patented Oct. 20, 1959

2,909,049

HAND KNITTING APPARATUS

Karl Rees, Ruti, Switzerland, assignor of one-half to Messrs. Striwa A.G., Vaduz, Liechtenstein

Application August 14, 1953, Serial No. 374,246

Claims priority, application Switzerland September 11, 1952

9 Claims. (Cl. 66—60)

The present invention relates to a hand knitting apparatus provided with latch needles, arranged parallel to each other, and with a manually actuated operating member, moving transversely to said latch needles, and is especially directed to a considerably simplified and improved apparatus of this type which for pulling down the knitted material does not require weights.

Known knitting machines or apparatus which are forming meshes by means of latch needles, employ various kinds of combs, and weights for pulling the knitted material in downward direction. The forward and backward movement of the needles is effected with the aid of a cam-box, the construction of which is rather complicated. The adjustment of the size of the meshes is usually effected in a cumbersome way by means of adjusting screws whose correct manipulation is rather difficult. Because of these disadvantages of construction the cost of manufacture of these machines is too high, and their manipulation is so complicated and difficult that these machines or apparatus are unsuited for use in the home on a broad basis, while simultaneously their producing capacity is likewise unsatisfactory.

The object of the invention is to eliminate these deficiencies, and to provide a hand knitting apparatus of simple construction and improved producing capacity, and which in addition to that can easily be manipulated.

The invention solves the problem by providing a hand knitting apparatus of the aforedescribed kind with automatic holding down means for the knitted material, which holding down means are controlled by the fed-in thread, and which essentially consist of a plurality of rotatable holding down hooks arranged in a rake-shaped member on a common shaft between every two adjacent latch needles.

The invention further provides for the adjustment of the size of the meshes an adjustable common shoulder for all of the holding down hooks consisting of a continuous shaft provided with cams or eccentric stop members.

Another important feature of the invention is the particular construction of the manually actuated operating member, which is devised as a carriage provided with rollers engaging in parallel guide bars, and which is moved by means of these rollers and guide bars forward and backward at uniform height above the needle bed transversely of the needles. According to the invention the carriage is provided on its underside with a plurality of guide members for each of the two directions of motion, with a stop bar extending in the direction of motion, and with a needle bridge arranged between said stop bar and one of the aforesaid guide members and provided with means for its adjustment in operating position from the upper side of the carriage.

Additional features and advantages of the invention will be understood from a consideration of the following detailed description taken in connection with the accompanying drawings, forming a part of this specification, and in which an embodiment of the invention has been

shown by way of example. However, it has to be understood that the invention is not confined to any strict conformity with the showing of the drawings, but may be changed or modified, so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings in which like or identical parts are referred to by the same reference numerals:

Fig. 1 is a perspective view of the whole apparatus;

Fig. 2 is a front view of a portion of the apparatus;

Fig. 3 is a top view of the portion of the apparatus illustrated in Fig. 2;

Fig. 4 is a vertical section on line III—III of Fig. 3;

Fig. 5 is a detail view of a movable plate provided with a leaf spring;

Fig. 6 is a sectional view on line VI—VI of Fig. 7, showing a preferred form of construction of the adjusting mechanism for the adjustment of the size of the meshes;

Fig. 7 is a view of the adjusting mechanism of Fig. 6, seen in the direction indicated by the arrow *a* in Fig. 6;

Fig. 8 is a view of the adjusting mechanism of Fig. 6, seen in the direction indicated by the arrow *b* in Fig. 6;

Fig. 9 is a detail view of the notched plate of the adjusting or setting mechanism of Fig. 6;

Fig. 10 is a side elevation, partly in section, of another form of construction of the adjusting mechanism for the adjustment of the size of the meshes;

Fig. 11 is a view of a portion of the continuous cam-shaft used as a means for the adjustment of the size of the meshes;

Fig. 12 is a view of a supporting plate for the support of the cam-shaft of Fig. 11, and of another shaft for the support of the holding down hooks;

Fig. 13 is a front view of a portion of a continuous cam-shaft for the simultaneous lifting of all the holding down hooks;

Fig. 14 is a side elevation of the cam-shaft of Fig. 13;

Fig. 15 is a top view of the underside of the carriage-like hand operating means, with the needle bridge in operating position;

Fig. 16 is a top view of the lower portion of the underside of the carriage of Fig. 15, with the needle bridge in inoperative position;

Fig. 17 is a side elevation of the carriage of Fig. 15, seen in the direction indicated by the arrow *a*;

Fig. 18 is a side view of a needle-heel, and of a springy guide member for the needle-heel, shown in positions in which they are not in contact with each other;

Fig. 19 is a side view of the needle-heel and guide member of Fig. 18, shown in positions in which guidance is afforded to the needle-heel by the guide member;

Fig. 20 is a side elevation, partly in section, on line XX—XX of Fig. 15, of a modified form of construction in which the hand operating means are not provided with rollers, but devised as a slide;

Fig. 21 is a top view of the front part of the carriage provided with guiding and protecting sheet metal members, and showing the latch needles moving into a position underneath the sheet metal members;

Fig. 22 is a side elevation of the front part of the carriage and of the needle bed, seen in the direction indicated by the arrow *c* in Fig. 21;

Fig. 23 is a top view of one of the guiding and protecting sheet metal members;

Fig. 24 is a front view of the sheet metal members of Fig. 23;

Fig. 25 is a sectional view of a modified form of construction of the slide of Fig. 20, provided with modified means for shifting the needle bridge from one final position to the other.

In the hand knitting apparatus illustrated in Figs. 1 to 4

the reference numeral **1** designates the needle board, consisting of either one or a plurality of parts, and produced from synthetic resin, molded material or the like. The parts of the needle board as well as the guide bars **2** are fastened by means of screws **3** on a base plate **4** of metal. The projections **2***a* of the needle bed partitions secure the guide bars **2** at accurately spaced distance from each other, and further secure the needle bed **1** in proper position with respect to the guide bars **2**. Arranged between the parallel partitions of the needle board **1** is a set of latch needles or tumbler needles **7**. Arranged at each end of the backward guide bar **2** is a stop contrivance for the carriage or slide **5**, which may consist of a buffer-like elastic stop member **8** (see Figs. 15 to 17) provided at the carriage **5**, and of a rigid stop member **9** provided at the guide bar **2**. It is possible to devise the construction in such a way that the rigid stop members **9** are shiftably arranged on the board **1** for displacement in a direction perpendicular to the direction in which the guide bars are extending, and elastically maintained in blocking position by means of springs or the like. The movable actuating means of the apparatus have been devised by way of example as the aforesaid carriage **5** guided by means of rollers **6** in profiled guide bars **2** (see Figs. 15, 17, 22).

At the front side of the apparatus the needle board **1** merges into a rake-shaped member **10**. Rotatably mounted in the slots of this member **10** between every two adjacent latch needles **7** are hook-shaped movable plates **11** (Figs. 1 to 5), which by means of draw springs **12** (Fig. 4) or staff springs or leaf springs **13** (Fig. 5) fixed at the lower end portion of the hook-shaped movable plates **11** are yieldingly held with their upper portion in the advanced position. During the knitting operation the knitting fed-in thread A rests and presses against the arc-shaped portion **11***a* of the movable plates **11**, forcing them toward a retracted position in which the upper portions are retracted until the fed-in thread A slips behind a hook-shaped portion **11***b* into a recess **11***c* and until through further backward movement of the individual latch needles **7** in each of these needles a loop or mesh has been formed. As soon as the fed-in thread A has slackened owing to forward slipping of the latch needles **7**, the movable plates **11** are pulled by their return springs **12** or **13** again toward an advanced position in which their upper portions are advanced to bear with their lower stop-edge **11***e* against the lower face **14** of the bottom of board **1**. The result of this is that the finished mesh-work is pulled by the movable plates **11**, particularly by the hook-shaped portions **11***b* of the latter, in downward direction and that the formed mesh is pulled against the upper side of the latch needle **7**. When the latch needles **7** are moving forward, the formed meshes slip further onto the needles, turn the tumblers down in rearward direction, so that the meshes come to rest behind the tumblers. For the next following mesh-forming action, the opened-up needles **7** are first moved forward again, seize with their hooks the thread A, and are then pulled backward in the aforedescribed manner for the formation of a new mesh, whereby the tumblers of the needles **7** are forced back into their forwardly extending position by the previously formed mesh slipping off the needles in forward direction, so that the fed-in thread A of the new mesh to be formed is pulled through the previously formed mesh.

As an adjustable shoulder or stop for the hook-shaped movable plates **11** during their swinging movement in the retracted position serves a contrivance, the details of which have been illustrated in Figs. 6 to 12. A cam-shaft **15** is rotatably supported in supporting plates **16** and forms for the second, lower arc-shaped portion **11***d* of the movable plates **11** an adjustable stop. Figs. 6, 7 and 8 show the adjusting means for the cam-shaft or adjusting shaft **15**. A disc **17** is provided on one side with a groove **17***a* in which engages the journal of the shaft **15** and a finger **36** connected to and extending from that journal. By means of a pin **37** the disc **17** is rigidly secured to the shaft **15**. On its opposite side the disc **17** is provided with a groove **17***b*, extending at a predetermined angle to the groove **17***a*. In the groove **17***b* engages a hand lever **18** which is rotatably supported at **19**. A leaf spring **20**, fastened to a cross plate of the disc **17**, presses the lever **18** against the disc **17**. The moving range of the lever **18** can be adjusted by means of an adjusting screw **21**.

Fig. 9 shows a notched plate **22** which is provided with a slot **22***a*, notches **22***b*, and a scale, and which is fastened at the casing **23** of the adjusting mechanism. The lever **18** can, through pressure against the handle **18***a*, be moved toward the right into the slot **22***a*, and be secured in position in one of the notches **22***b* through pressure exerted against it by the spring **20**. The positions 1 to 4 of the notched plate **22** correspond approximately to the needle numbers and mesh sizes customary for hand knitting apparatus. Setting of the hand lever **18** for a desired mesh size results in corresponding rotation of the cam-shaft **15**.

The adjusting means of the cam-shaft **15** may also be devised as illustrated by way of example in Fig. 10. In this case the disc **17** is stationarily arranged at the machine frame or casing, and provided with a bore-hole for the journal of the shaft **15**, as well as with a front toothing **38**, in which engages with a corresponding front toothing an actuating member or casing **39**. The casing **39** is shiftably arranged for displacement in axial direction on a square portion of the shaft **15**, and is yieldingly secured in meshing position with the disc **17** by means of a spring **40**. When the cam-shaft **15** is to be adjusted, the casing **39** is pulled by hand out of its meshing position toward the right against the pressure of the spring **40**, and then, after corresponding rotation of itself and of the cam-shaft, permitted to slip back into meshing position with the toothing **38** of the disc **17**. The graduation for the adjustment according to desired mesh sizes is marked on one part adjacent the toothing **38**, while the appertaining marks are provided on the other part.

The movable plates **11**, which during the backward movement of the needles **7** are swung by the thread A in upward and rearward direction, hit with their arc-shaped portion **11***d* against the cam-shaft **15**, so that the needles **7**, when pulled still further toward the rear, form each time between the recesses **11***c* of two adjacent movable plates **11** a mesh of corresponding size. If the cam-shaft is so adjusted that the swinging movement performed by the movable plates is a rather limited one, the mesh produced will be a large one (size 4). If, on the other hand, the cam-shaft is adjusted in such a way that increased swinging of the movable plates in the retracted position is thereby enabled, while the latch needles **7** are performing the same backward movement, a small mesh will be formed (size 1). (See Fig. 4, position B or C.)

Figs. 11 and 12 show how the cam-shaft or adjusting shaft **15** may be supported by a plurality of vertical supporting plates **16** arranged at uniformly spaced distances from one another. For passing the shaft **15** with its cams **15***a* through the plates **16**, the plates are provided with bore-holes for the shaft, and with slots **24** extending from the bore-holes, through which during the assembly work the cams **15***a* are pushed (Fig. 12). For the simultaneous lifting of all movable plates **11**, the invention provides the apparatus with a second cam-shaft **25**. For the support of this cam-shaft, the plates **16** are provided with another bore and appertaining slot **25***c* for the cams **25***a* of this shaft. The shifting of this cam-shaft is effected by means of the handle **25***b* (see Figs. 12, 13, 14). The vertical supporting plates **16** are pushed into corresponding slots of the rake-shaped member **10**, and provided at their rear end with a projecting portion **16***a* which is clampingly fastened between the needle board **1** and the base

plate 4. By means of the continuous shaft 26, on which all of the movable plates 11 are supported at 26a, and which in all of the supporting plates 16 is supported at 26b, the position of the supporting plates 16 with respect to the rake-shaped member 10 and the movable plates 11 is accurately determined (see Figs. 4, 12, 22). The camshaft 25 projects with its cams 25a through the recess 11f of the movable plates 11, and enables, as already mentioned, the simultaneous lifting of all movable plates 11. This is desirable when for the patterning of the fabric whole rows of meshes have to be pulled forward, or detached from the needles, or transferred from one needle to another. In order to effect this lifting of the movable plates 11, the handles 25b provided at both ends of the shaft 25, are simply turned backward with the result that the movable plates 11 are slightly lifted by the cams 25a engaging in the recesses 11f of the movable plates 11 (Figs. 4 and 5).

Details of the construction of the carriage or slide 5 as movable actuating means are illustrated in Figs. 15 to 17. The carriage is provided with a handle 5a by means of which it can be moved forward and backward above the needle board 1. With the only exception of a needle bridge 27, all of the guiding means for the heels of the needles are rigidly secured to the carriage. Without the use of needle lifting and lowering means, the needles 7 move, when they are in the position 7a near the front bar 2, along the guide member 28 into ready-for-action position. From here the needles slip along the outer guide surface 29a of the first guide member 29 and then pass via the opened-up needle bridge 27 onto the inner guide surface 29b of the second guide member 29 by which they are guided back in forward direction, whereupon they return via the second guide member 28 into ready-for-action position. Fig. 15 shows the aforedescribed course of action with the carriage 5 moving in the direction from left to right. When the moving direction of the carriage is reversed, the course of action is likewise reversed. The guiding of the latch needles 7 resembles the way in which the needles are guided in known flat knitting machines or apparatus operating with latch needles. The guide members 28, formed from sheet metal, and the guide members 29, consisting of guiding blocks, are so shaped and arranged that the needles are guided along their guide edges in definitely determined undulating lines in order to prevent the guiding means and heels of the needles from getting damaged through shocks, and in order to guarantee smooth sliding of the heels of the needles along the guiding means. In this way the life-time of the needles is prolonged, the needle board maintained in proper working condition, and the moving of the carriage facilitated. The entire working action of the needles 7 within the range of the carriage 5 resembles a harmonious undulating line (Figs. 3, 15, 21). If the carriage 5 is moved over the needles 7 at a time when there is no fed-in thread A in the apparatus, it may happen that a needle 7 moves too far toward the rear and hits against a corner 27a of the needle bridge 27 and thus causes injuring of the needle board 1 and of the needle 7. In order to prevent this, the invention provides the carriage with a stop bar 30, against which the needle bridge 27 rests in its opened-up position. To further prevent the two ends 30a of the stop bar 30 from causing similar disadvantageous effects to the needle board 1 and the needles 7, the ends 30a are provided with deflecting springs 31 of warped, screw-like formation. Figs. 18 and 19 show the heel of a needle 7 and a deflecting spring 31 in a position in which they are not in contact with each other, and in a position in which the heel of the needle is pushed aside by the spring 31. If one or a plurality of needle-heels hit one after the other with exactly the center of the heels against the edge of the spring 31 at D, the spring is lifted slightly and, because of its warped shape, gives way in lateral direction and urges the endangered needle-heels in downward direction (see needle-heels 7c in Fig. 16). However, a situation like this cannot occur during the knitting operation, but only then when there is no thread in the apparatus. Fig. 15 also shows the out-of-action position of the needles 7b at the backward guide bar 2. If the slide is constructed like this, injuring of the needle board 1 and of the needles 7 is reliably prevented.

Fig. 16 shows the rear portion of the carriage 5 with the needle bridge 27 in closed position. With the needle bridge 27 in this position, the needles 7 pass first, as in the working operation illustrated in Fig. 15, from ready-for-action position along the guide edge 29a of the guide member 29 toward the rear, but then remain in this position. The result is that the needles 7, when moving from ready-for-action position toward the rear, form meshes out of the fed-in thread A, which meshes remain suspended in the needles 7. During the knitting action illustrated in Fig. 15 the meshes are formed in the same way. However, they do not remain in the needle hooks, but are, during the forward movement of the needles 7 via the guide surface of the second guide member 29, stripped back over the needle neck, until they come to rest behind the opened-up tumblers of the needle hooks 7. This procedure is necessary in order to make the needles 7 ready for the reception of the thread A of the new row of meshes to be formed. Hence, if the knitted fabric is, by means of the operating action of Fig. 16, permitted to remain in the needle hooks, there will, when the knitting continues, no new row of meshes be formed, and putting in of a thread A is therefore unnecessary. The carriage 5 can, therefore, be moved over the needles 7 any number of times without causing the knitted material to become detached from the hooks, which would be the case if the needle bridge 27 were in the position illustrated in Fig. 15. That is why the adjustment of the needle bridge 27, as shown in Fig. 16, permits the production of a variety of patterns, and in addition to that has the following advantages:

When the needle bridge 27 is in closing position as illustrated in Fig. 16, the lever edge of the needle bridge is somewhat removed from the rear edges of the guide members 29. This is necessary in order to relieve the needles of the stress. The shifting of the needle bridge 27 from opened-up into closing position is effected from the upper side of the carriage 5 with the aid of a knurled screw nut 27c as a handle. The handle 27c is mounted on the threaded pin of a projecting portion 27b of the needle bridge 27, which projecting portion projects through a slot 32 extending parallel to the needles 7. In the slot 32 the portion 27b can be shifted forward and backward by means of the handle 27c, whereby the handle is loosened prior to the shifting and retightened after it (Figs. 17, 20). The projecting portion 27b also secures the needle bridge 27 in correct position with respect to the guide members 29, and guarantees the straight-lined shifting in the slot 32. The carriage 5 is guided along the profiled guide bars 2 by means of rollers 6 provided with circumferential grooves, and can easily be moved forward and backward above the needle bed 1. The grooved rollers 6 secure the carriage at non-changing height and in proper position with respect to the guide bars 2, the needle bed 1, and all of the other parts (Figs. 15, 16, 17, 22).

Instead of devising the operating means 5 as a carriage provided with rollers 6, it is also possible to devise it as a slide provided with suitably shaped slide members 41 of easy sliding artificial material fastened to the slide and engaging in U-shaped guide bars 2 of brass or the like, as shown in Fig. 20.

Fastened to the carriage or slide 5 by means of the arms 33 is another contrivance which is illustrated in Figs. 21 to 24. Fig. 21 shows how this contrivance is secured to the carriage 5 which is moving over the needle bed 1 in the direction from left to right. On the right side are backward moving needles 7, and on the left side are

needles which are engaged in a forward pushing movement. If the moving direction of the carriage or slide is reversed the backward moving needles are on the left side, while the forward pushing needles are on the right side. The thread A has to be put in once from left to right, and after that in reversed direction.

Figs. 22, 23, 24 show on an enlarged scale several views of the aforesaid contrivance which will hereafter be described in detail. From the construction, arrangement and operation of the movable plates **11** it is evident that the knitted material is no longer pulled down by weights, as hitherto has been the custom in knitting machines or apparatus operating with latch needles, but by means of hook-shaped portions of the movable plates **11**. As during the forward movement of the needles the knitted material is held back already by the hook-shaped portions **11***b* of the movable plates, the sheet metal members **34** (at the carriage **5**) merely prevent with their edge portions **34***a* the knitted material from slipping down from the hook-shaped portions **11***b*, which slipping down might easily happen to the last meshes on the left and right, as these meshes are supported in their position only on their inner side. The lower edge portion **34***a* of the sheet metal members **34** merely serves as a barrier. The sheet metal member **34** which is in front (seen in the direction of motion) prevents forward slipping of the first mesh when the thread is put in. The other sheet metal member **34** prevents loosening of the last mesh when the last latch needle **7** is pushed out. All of the other meshes mutually support each other in position, and the two edges **34***a* glide past the knitted material without pulling it along. The bent-up edge **34***b* facilitates the opening of the tumblers of the needles **7**, and secures the tumblers in opened-up position when a new thread is to be put in. When during the renewed forward pushing movement of the needle **7** the mesh already in the needle slips back on the latter, the possibility exists that the tumbler, after backward slipping of the mesh on the needle neck, might turn upwards and thus close the needle too early, which for the formation of the next following row of meshes would result in a ladder. This is prevented by the edge **34***b* (of the sheet metal members **34**) against which, when the forward movement of the latch needles continues, prematurely closed tumblers hit and are thus turned back to non-closing position (see Fig. 22, needle **7***a*, and Fig. 21, needle **7***d*). The outwardly inclined and slightly upwardly bent sheet metal end **34***c* guarantees the smooth entry of the needles **7** into the chamber formed at the carriage by the sheet metal members **34**, and turns tumblers, which have been moved too early into closing position, reliably backward into opened-up position, so that the new thread A always finds an open needle hook. Another object of this sheet metal member arrangement is to enable an easy putting-in by hand of the thread A, without the necessity of accurate precision.

Figs. 21 and 23 show how the thread A is pulled into the backward moving latch needles **7**. The place at which the tumblers of the needles **7** are turning backward is, when the carriage is moving from left to right, near the right arm **33**, and, when the carriage is moving in the opposite direction, near the left arm **33**. It will be seen, therefore, that the thread A has to be fed in alternately at movement of the carriage toward the right, and at movement of the carriage toward the left and so on. According to the invention the transfer of the thread A is effected with the aid of thread guiding means of very simple construction, consisting merely of a pair of loop-shaped sheet metal members **34***d* bent up from the sheet metal members **34**. The two loops **34***d* overlap each other, whereby between the overlapping portions a gap **34***e* is formed (see Figs. 21 and 22). The outer ends of the edge **34***b* which opens the tumblers are provided with small rounded recesses **34***f* serving as thread guides. For putting in the thread A, the latter is pulled from below in the direction indicated by the arrow *a* by an S-movement through the aforesaid gap **34***e*, between the sheet metal members **34** (Fig. 21), and over the arc **34***g*, formed by the loops **34***d*, and then put into the recess **34***f* which is facing the knitted material. After that the thread A is loosely tightened across the arc **34***g* of the forward sheet metal loop **34***c*, and the carriage moved in working direction. For knitting in the opposite direction, the thread A is merely slightly lifted and transferred to the opposite thread guiding recess **34***f*, whereby the hand describes about a semi-circle as indicated by the arrow *d* in Fig. 21, and whereby the arc-shaped edges **34***g* serve as a guiding means for the thread. Hence, one of the hands moves the carriage **5** by means of the handle **5***a*, while the other hand, at every change of direction of the carriage or slide, performs with the thread A a semi-circular movement, whereby the guidance of the thread is considerably facilitated, and whereby the thread is put on the needles **7** exactly at the correct place. The unthreading is carried out in reversed order, also via the gap **34***e*. Instead of employing sheet metal loops **34***d*, it is also possible to arrange between the members **34** or their supporting arms **33** wire loops of corresponding shape.

In order to facilitate pattern knitting or the like, the invention provides the carriage or slide **5** with a counting device **42**, recording the number of the forward and backward movements performed by the carriage or slide. The counting device includes shiftable driving means provided at the counting device, and stationary actuating means for said shiftable driving means arranged at one or a plurality of places of the guide bars **2** or of the frame-work of the apparatus. In the embodiment illustrated in Fig. 3, the shiftable driving means consist of a pin **44** shiftably arranged transversely to the direction of motion of the carriage or slide **5** and at one end yieldingly supported in operating position by means of a spring **45**, while its other end is in operating engagement with the counting device by means of gear wheels, levers or the like. At its yieldingly supported end the pin **44** carries a contact member **46** provided with one or a plurality of contact surfaces of curved or inclined formation adapted for engagement with the aforesaid stationary actuating means **43**, so that each time said contact member **46** passes by said stationary actuating member **43**, said contact member displaced said shiftable pin **44** and thereby causes said pin to actuate said counting device. By providing the apparatus with a plurality of stationary actuating members **43** it is possible to also employ the counting device for the knitting of short fabrics extending only over a portion of the entire length of the apparatus.

In the modified form of construction illustrated in Fig. 25, the needle bridge **27** is guided in the slit **32** of the cover plate **48** of the carriage or slides. Said needle bridge **27** is also movably connected to a hand lever **49**, which is pivotally mounted at **52** on a supporting member **47** positioned above the cover plate **48** of the carriage or slide **5**. The lever **49** is guided in a slot **50** extending perpendicularly to the direction of motion of the carriage or slide **5**, and is yieldingly retained in its final positions through self-locking or other locking means, such as tiltable pressure springs **53**, **54** on opposite sides of said lever **49** between studs **55** at the lever **49** and studs **56** at the supporting member **47**. The outer end of the lever **49**, which projects from the supporting member **47** through the slot **50** and which is provided with a handle **51**, is located in the vicinity of the handle **5***a* of the carriage or slide **5**, so that it can easily be moved by a finger of the hand operating the carriage or slide **5** from one final position to the other. By the distance between the studs **55** at the lever **49** and the studs **56** at the supporting member **47** the screw-like wound springs **53**, **54** always try to extend and to form bows to press the lever

49 in any of the two end positions. If the lever 49 is moved by one finger of the hand operating the carriage or slide 5 and released, the springs 53, 54 always move the lever and therewith also the needle bridge 27 in one of the two end positions.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A hand knitting apparatus comprising in combination elongated supporting means, a flat elongated needle board mounted on said supporting means, a row of spaced parallel latch needles each transversely shiftably positioned in said needle board and projecting therefrom with a hooked end portion for receiving thread fed into the apparatus during the knitting operation, a row of parallel movable plates rotatably mounted on said board and positioned between said needle projections whereby the edges of said plates are adapted to serve as holding down means for the knitted material and as movable combplates for the fed-in thread during the knitting operation, a pair of parallel profiled guide bars mounted on said needle board transversely above said needles and suitably spaced apart, movable needle actuating means guided in said guide bars and adapted to move consecutively each of said needles from the advanced thread receiving position between two adjacent movable combplates to a retracted position and then back again into said advanced position.

2. A hand knitting apparatus comprising in combination an elongated supporting plate, a flat elongated needle board mounted on said supporting plate, a row of spaced parallel latch needles transversely shiftably positioned in said needle board and projecting therefrom with a hooked end portion for receiving thread fed into the apparatus during the knitting operation, transverse parallel slots in said supporting plate between said needle projections, a supporting shaft in said supporting plate in the range of said parallel slots, a row of parallel movable plates, rotatably mounted on said supporting shaft within said slots, whereby the edges of said plates are adapted to serve as holding down means for the knitted material and as movable combplates for the fed-in thread during the knitting operation, a pair of parallel profiled guide bars mounted on said needle board transversely above said needles and suitably spaced apart, movable needle actuating means guided in said guide bars adapted to move consecutively each of said needles from the advanced thread receiving position between two adjacent movable combplates to retracted position and then back again into said advanced position.

3. A hand knitting apparatus comprising in combination an elongated supporting plate, a flat elongated needle board mounted on said supporting plate, a row of spaced parallel latch needles transversely shiftably positioned in said needle board and projecting therefrom with a hooked end portion for receiving thread fed into the apparatus during the knitting operation, a row of parallel movable plates, rotatably mounted on said board and positioned between said needle projections, each of said movable plates being provided with a first upper arc-shaped edge portion facing the fed-in thread for the latter to act upon, a subsequent hook-shaped portion, a first adjoining recess for the fed-in thread, a lower second arc-shaped edge portion beneath said first recess, a supporting edge portion and a second recess at the lower rear side of said movable plate, and a spring means for yieldingly holding said movable plates with supporting edge portion against said supporting plate, a pair of parallel profiled guide bars mounted on said needle board transversely above said needles and suitably spaced apart, movable needle actuating means guided in said guide bars and adapted to move consecutively each of said needles from the advanced thread receiving position between two adjacent movable plates to a retracted position and then back again to the advanced position during the knitting operation.

4. A hand knitting apparatus comprising in combination an elongated supporting plate, a flat needle board mounted on said supporting plate, a row of spaced parallel latch needles transversely shiftably positioned in said needle board and projecting therefrom with a hooked end portion for receiving thread fed into the apparatus during the knitting operation, a row of parallel movable plates rotatably mounted on said board and positioned between said needle projections, each of them being provided with a first upper arc-shaped edge portion facing the fed-in thread for the latter to act upon, a subsequent hook-shaped portion, a first adjoining recess for the fed-in thread and a lower second arc-shaped portion beneath said recess, a lower supporting edge portion, and a second recess at the lower rear side of said movable plate, and a spring means fastened to each movable plate for yieldingly holding said lower edge portion against said supporting plate and the movable plate with its first upper arc-shaped portion in the advanced position, abutment means for said parallel movable plates, for adjustably limiting the rotary movement of said movable plates during knitting operation, consisting of an elongated shaft rotatably mounted on said supporting plate and provided with cams suitably devised and positioned to cooperate with said lower second arc-shaped portion of said parallel movable plates, a pair of parallel profiled guide bars mounted on said needle board and transversely above said needles and suitably spaced apart, movable needle actuating means guided in said guide bars and adapted to move consecutively each of said needles from the advanced thread receiving position between two adjacent movable plates to a retracted position and then back again to said advanced position, during the knitting operation.

5. A hand knitting apparatus as specified in claim 4, including an adjusting handle coupled with said rotatable elongated cam-shaft as abutment means for said movable plates, and a notched plate by means of which said handle can be secured in any adjusted position.

6. A hand knitting apparatus as specified in claim 4, including a plurality of vertical supporting plates uniformly distributed over the entire length of said horizontal supporting plate, in which said elongated cam-shaft as abutment means for the adjustment of said movable hook-shaped plates is rotatably supported.

7. A hand knitting apparatus as specified in claim 4, including as additional abutment means for said movable plates a second elongated cam-shaft suitably devised and positioned to engage with its abutment cams in said lower second recess of the rearward portion of said movable plates, and a plurality of vertical supporting plates uniformly distributed over the entire length of the horizontal supporting plate in which said second elongated cam-shaft as abutment means for the adjustment of the movable plates is rotatably supported.

8. A hand knitting apparatus comprising in combination an elongated supporting plate, a flat elongated needle board mounted on said supporting plate, a row of spaced latch needles each transversely shiftably positioned in said needle board and projecting therefrom with a hooked end portion for receiving thread fed into the apparatus during the knitting operation and having an upwardly extending butt at its rearward portion, a row of parallel movable plates rotatably mounted on said board and positioned between said needle projections whereby the edges of said plates are adapted to serve as holding down means for the knitted material and as movable combplates for the fed-in thread during the knitting operation, a pair of parallel profiled guide bars mounted on said needle board transversely above said needles and suitably spaced apart, movable needle actuating means guided in said guide bars and including a slide or carriage having entering and exit guide members for the needle butts and an intermediate needle bridge of substantially triangular shape adjustably

positioned between said entering and exit guide members, adapted to move consecutively each of said needles from the advanced thread receiving position between two adjacent movable plates to a retracted position and then back again into said advanced position during the knitting operation and manipulating means for said adjustable needle bridge for adjustment of the movable needle bridge from the outside of said movable actuating means.

9. A hand knitting apparatus as specified in claim 8, including shielding means for the projecting portions of the needles disposed on said movable actuating means in a protective position for said needles in their advanced position, means for guiding and retaining slidingly said fed-in thread during the knitting operation in correct inserting position with respect to the projecting needle portions in their advanced position, disposed at opposite ends of said movable actuating means, arc-shaped means projecting from said shielding means and connected to thread guiding and retaining means at opposite ends of said movable actuating means adapted to serve as guiding means for the easy transfer of the fed-in thread by the hand of the operator from one of said thread guiding and retaining means to the other thread guiding and retaining means and vice versa.

References Cited in the file of this patent

UNITED STATES PATENTS

499,648	Bennor	June 13, 1893
2,670,618	Von Skene et al.	Mar. 2, 1954